



The Army's Future Combat System (FCS): Background and Issues for Congress

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Summary

The Future Combat System (FCS) is a multiyear, multibillion dollar program at the heart of the Army's transformation efforts. It is the Army's major research, development, and acquisition program consisting of 14 manned and unmanned systems tied together by an extensive communications and information network. FCS is intended to replace current systems such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. The FCS program has been characterized by the Army and others as a high-risk venture due to the advanced technologies involved and the challenge of networking all of the FCS subsystems together so that FCS-equipped units can function as intended.

The FCS program exists in a dynamic national security environment which could significantly influence the program's outcome. Some question if FCS, envisioned and designed prior to September 11, 2001 to combat conventional land forces, is relevant in current and anticipated future conflicts where counterinsurgency and stabilization operations are expected to be the norm. The Army contends, however, that FCS is relevant throughout the "entire spectrum of conflict" and that a number of FCS technologies and systems have been used effectively in counterinsurgency and stabilization campaigns in Iraq and Afghanistan. The economic crisis and budgetary pressures may also play a prominent role in the future of the FCS program. FCS has achieved a number of programmatic milestones and is transitioning from a purely conceptual program to one where prototypes of many of the 14 FCS systems are under development. With a variety of estimates on the total cost of the FCS program, questions have been raised about FCS affordability. In 2007, citing the impact of past budget cuts, the Army restructured the program from 18 to 14 systems. In June 2008, primarily in response to both congressional and Department of Defense (DOD) concerns about deploying FCS technologies to forces in the field sooner and overall program affordability, the Army restructured the program again. As currently restructured, the Army will instead focus its initial FCS equipping efforts on Infantry Brigade Combat Teams (IBCTs) as opposed to heavier FCS BCTs.

The overall FCS program is in a variety of developmental phases, with some technologies having been fielded to units and others still under development with varying degrees of success. The 111th Congress, in its appropriation, authorization, and oversight roles may wish to review the FCS program in terms of its projected capabilities, relevance to current and possible future military operations, and program costs. This report will be updated as the situation warrants.

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Issues for Congress

The Future Combat System (FCS) is a multiyear, multibillion-dollar program at the heart of the Army's transformation efforts. It is the Army's major research, development, and acquisition program and is to consist of 14 manned and unmanned systems tied together by an extensive communications and information network. FCS is intended to replace current systems such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. The Army's success criteria for FCS is that it should be "as good as or better than" the Army's current force in terms of "lethality, survivability, responsiveness, and sustainability."¹

The primary issues presented to 111th Congress are the capabilities and affordability of the FCS program, and the likelihood, given a myriad of factors, that the Army will be able to field its first FCS Brigade Combat Team (BCT) by 2015 and eventually field up to 15 FCS BCTs. Key oversight questions for consideration include the following:

- Future of FCS BCTs.
- Impact of the June 2008 Restructuring.
- FCS Complementary Programs.
- Manned Ground Vehicle Development.
- Constrained Defense Budgets, Economic Issues, and the Future of FCS.

The 111th Congress's decisions on these and other related issues could have significant implications for U.S. national security, Army funding requirements, and future congressional oversight activities. This report will address a variety of issues including the program's timeline, budget, program management issues, program developmental progress and challenges, and how other related programs could affect FCS.

Background

FCS Program Origins

In October 1999, then Chief of Staff of the Army (CSA) General Eric Shinseki introduced the Army's transformation strategy which was intended to convert all of the Army's divisions (called Legacy Forces) into new organizations called the Objective Force. General Shinseki's intent was to make the Army lighter, more modular, and—most importantly—more deployable. General Shinseki's deployment goals were to deploy a brigade² in four days, a division in five days, and five divisions in 30 days.³ As part of this transformation, the Army adopted the Future Combat System (FCS) as a major acquisition program to equip the Objective Force.⁴

¹ Government Accountability Office (GAO) Report "Defense Acquisitions: Improved Business Case is Needed for Future Combat System's Successful Outcome," GAO-06-367, March 2006, p. 2.

² According to Department of the Army Pamphlet 10-1, "Organization of the United States Army," dated June 14, 1994, a brigade consists of approximately 3,000 to 5,000 soldiers and a division consists of approximately 10,000 to 18,000 soldiers.

³ Frank Tiboni, "Army's Future Combat Systems at the Heart of Transformation," Federal Computer Week, February (continued...)

This transformation, due to its complexity and uncertainty, was scheduled to take place over the course of three decades, with the first FCS-equipped objective force unit reportedly becoming operational in 2011 and the entire force transformed by 2032.⁵ In order to mitigate the risk associated with the Objective Force and to address the near-term need for more deployable and capable units, the Army's transformation plan called for the development of brigade-sized units called the Interim Force in both the active Army and the Army National Guard. These Interim Brigade Combat Teams (IBCTs) were the predecessors to the Army's current Stryker Brigade Combat Teams (SBCTs).⁶

General Shinseki's vision for the FCS was that it would consist of smaller and lighter ground and air vehicles—manned, unmanned, and robotic—and would employ advanced offensive, defensive, and communications/information systems to “outsmart and outmaneuver heavier enemy forces on the battlefield.”⁷ In order to initiate the FCS program, General Shinseki turned to the Defense Advanced Research Projects Agency (DARPA), not only because of its proven ability to manage highly conceptual and scientifically-challenging projects, but also because he reportedly felt that he would receive a great deal of opposition from senior Army leaders who advocated heavier and more powerful vehicles such as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle. In May 2000, DARPA awarded four contracts to four industry teams to develop FCS designs and in March 2002, the Army chose Boeing and Science Applications International Corporation (SAIC) to serve as the lead systems integrators to oversee certain aspects of the development of the FCS's 18 original systems. On May 14, 2003, the Defense Acquisition Board⁸ (DAB) approved the FCS's next acquisition phase and in August 2004 Boeing and SAIC awarded contracts to 21 companies to design and build its various platforms and hardware and software.

The FCS Program

Program Overview⁹

The Army describes FCS as a joint (involving the other services) networked “system of systems.” FCS systems are to be connected by means of an advanced network architecture that would permit connectivity with other services, situational awareness and understanding, and

(...continued)

9, 2004.

⁴ James Jay Carafano, “The Army Goes Rolling Along: New Service Transformation Agenda Suggests Promise and Problems,” *Heritage Foundation*, February 23, 2004, p. 5.

⁵ Bruce R. Nardulli and Thomas L. McNaugher, “The Army: Toward the Objective Force,” in Hans Binnendijk, ed. *Transforming America's Military* (National Defense University Press, 2002), p. 106.

⁶ The Stryker is the Army's name for the family of wheeled armored vehicles that will constitute most of the brigade's combat and combat support vehicles. Annex A (Modular Conversion) to Army Campaign Plan, Change 2, September 30, 2005, p. A-1.

⁷ The following description of the early stages of the FCS program is taken from Frank Tiboni's *Army's Future Combat Systems at the Heart of Transformation*.

⁸ The Defense Acquisition Board (DAB) is the Defense Department's senior-level forum for advising the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) on critical decisions concerning DAB-managed programs and special interest programs.

⁹ Information in this section is taken from the FCS Program Manager System Overview Briefing, December 10, 2008.

synchronized operations that are currently unachievable by Army combat forces. FCS is intended to network with existing forces, systems currently in development, and systems that will be developed in the future. At present, the Army intends to eventually field 15 FCS BCTs equipped with new FCS manned ground vehicles and will provide selected FCS communications, sensor, and unmanned vehicle technologies to all 43 of its Infantry Brigade Combat Teams (IBCTs) by FY2025.

Structure

FCS Brigade Combat Team (BCT) units would include the following:

- Unattended ground sensors (UGS);
- Two classes of unmanned aerial vehicles (UAVs);
- Three classes of unmanned ground vehicles (UGVs): the Armed Robotic Vehicle - Assault (Light) (ARV-AL), the Small Unmanned Ground Vehicle (SUGV), and the Multifunctional Utility/Logistics and Equipment Countermining and Transport Vehicle (MULE-T/C);
- Eight types of Manned Ground Vehicles (MGVs);
- The Network; and
- The individual soldier and his personal equipment and weapons.

The FCS is to serve as the core building block of the Army's Future Force. FCS BCTs are to consist of:

- Three FCS-equipped Combined Arms battalions (CABs);
- One Non-Line-of-Sight (NLOS) Cannon battalion;
- One Reconnaissance, Surveillance, and Target Acquisition (RSTA) squadron;
- One Brigade Support battalion (BSB);
- One Brigade Intelligence and Communications company (BICC); and
- One Headquarters company.

For a more detailed description of FCS subsystems, see **Appendix**.

Capabilities¹⁰

According to the Army, the FCS Brigade Combat Team (BCT) will be designed to be:

- Self-sufficient for 72 hours of high-intensity combat;
- Self-sufficient for seven days in a low to mid-intensity environment;

¹⁰ Information in this section is taken from the 2007 Army Modernization Plan, March 5, 2007, pp. 8-11, and FCS Brigade Combat Team 14+1+1 Systems Overview 14 March 2007, at <http://www.army.mil/fcs/whitepaper/FCSwhitepaper07.pdf>.

- Able to reduce the traditional logistics footprint for fuel, water, ammunition, and repair parts by 30% to 70%;
- Sixty percent more strategically deployable than current heavy BCTs; and
- Able to operate across larger areas with fewer soldiers.

FCS Program Timeline

FCS completed its System of Systems Preliminary Design Review (PDR) in February 2009. The PDR is described as “a multi-disciplined technical review to ensure that a system is ready to proceed into detailed design and can meet stated performance requirements within cost, schedule, risk, and other system restraints.”¹¹ Despite the Army’s June 28, 2008, decision to significantly restructure the FCS program “to accelerate FCS deliveries to IBCTs,”¹² Army officials have stated that “the core program has not changed in terms of its time lines.”¹³

2009 “Go or No Go” Review ¹⁴

In 2006 Congress directed that after the February 2009 FCS System of Systems Preliminary Design Review (PDR), that DOD conduct a FCS Milestone Review to assess (1) if warfighter’s needs are valid and can best be met through the FCS program; (2) whether the concept of the program can be developed and produced within existing resources; and (3) should FCS continue as currently structured, continue in a restructured form or; (4) be terminated. This “Go or No Go” Review is currently scheduled for August 2009.

Program Schedule

As of March 2009, the FCS program is operating under the schedule depicted below:

Table I. FCS Program Schedule¹⁵

Event	Date (FY)	Event Description
Systems of Systems Preliminary Design Review (PDR)	May 2009	A technical review to evaluate the progress and technical adequacy of each major program item. It also examines compatibility with performance and engineering requirements.
Defense Acquisition Board (DAB) Review	July	The DAB Review will consider the entire FCS core program and determine viability and technical maturity in order to move the program into the hardware

¹¹ “Glossary of Defense Acquisition Acronyms and Terms,” Defense Acquisition University, Fort Belvoir, VA, 12th ed., July 2005, p. B-121.

¹² U.S. Army News Release, “Army to Accelerate Future Combat Systems Deliveries (FCS) to Infantry Brigade Combat Teams,” Army Public Affairs Office, Washington D.C., June 26, 2008.

¹³ Ann Roosevelt, “FCS Needs No New Funds to Accelerate, Officials Say,” *Defense Daily*, June 27, 2008.

¹⁴ For information in this section see P.L. 109-364, John Warner National Defense Authorization Act for Fiscal Year 2007, Section 214.

¹⁵ MG Charles A. Cartwright and Mr. Tony Melita, Future Combat Systems (Brigade Combat Team) Defense Acquisition Board In-Process Review, June 13, 2007, p. 4, and FCS Meeting with the Army’s Capability Integration Center, March 3, 2009.

Event	Date (FY)	Event Description
	2009	prototype build phase.
FCS Milestone "Go or No Go" Review	August 2009	A DOD review established by Section 214, P.L. 109-364 to determine if the FCS program should continue as planned, be restructured, or be terminated.
Systems of Systems Critical Design Review (CDR)	Dec 2011	A technical review to determine if the detailed design satisfies performance and engineering requirements. Also determines compatibility between equipment, computers, and personnel. Assesses producibility and program risk areas.
Design Readiness Review	2011	Evaluates design maturity, based on the number of successfully completed system and subsystem design reviews.
Milestone C	2013	Milestone C approves the program's entry into the Production and Deployment (P&D) Phase. The P&D Phase consists of two efforts—Low Rate Initial Production (LRIP) and Full Rate Production and Deployment (FRP&D). The purpose of the P&D Phase is to achieve an operational capability that satisfies the mission need.
Initial Operational Capability (IOC)	2015	IOC is defined as the first attainment of the capability to employ the system as intended. (Part of the P&D Phase).
Full Operational Capability	2017	The full attainment of the capability to employ the system, including a fully manned, equipped, trained, and logistically supported force. (Part of the P&D Phase).

Note: Event descriptions in this table are taken from the Defense Acquisition Acronyms and Terms Glossary published by the Defense Acquisition University, Fort Belvoir, VA, 12th ed., July 2005.

Future Defense Spending and FCS

As previously noted, the FCS program exists in a “dynamic national security environment which could significantly influence the program’s outcome.” In the past, that environment took into account the current, counterinsurgency-type operations in Iraq and Afghanistan and the belief that these types of campaigns would likely be the norm for the Army in the future. While these considerations remain relevant, there are emerging issues that will also factor into the current and future security environment. One of these considerations how to best balance the needs for conventional and irregular capabilities in future defense spending.¹⁶ These needs will likely be examined by the ongoing 2010 Quadrennial Defense Review (QDR), and Secretary of Defense Gates has repeatedly advised the Services to avoid what he has termed “next-war-itis”—the tendency to procure technologically advanced, costly major weapons systems that have questionable use in counterinsurgency-style operations such as in Iraq and Afghanistan. Programs such as the F-35 Joint Strike Fighter, the Marine’s Expeditionary Fighting Vehicle (EFV), and FCS have been mentioned as major, multi-year modernization programs with questionable utility and that will likely be highly scrutinized during the 2010 QDR. The Army is said to be examining the relevancy of FCS in terms of Iraq and Afghanistan, as the Secretary of Defense suggested that “gold-plated programs” will be targets of budget cuts as he looks for programs that “provide a 75 percent solution to a warfighting requirement rather than an exquisite system that meets a 99 percent solution.”¹⁷ Another budget-related factor is the current financial crisis. The

¹⁶ Marina Malenic, “Pentagon Seeks to Rebalance Conventional, Irregular Capabilities in Future Spending,” *Defense Daily*, February 13, 2009.

¹⁷ Jason Sherman, “Army Asks Broad Question in Girding for QDR: Is FCS Gold-Plated,” *InsideDefense.com*, February 20, 2009.

Administration is expected to significantly change the military's investment programs, with some experts forecasting "huge budget cuts ... mostly likely beginning in FY2011," which will further influence ongoing FCS affordability and relevancy debates.¹⁸ The Army, in response to these and other related debates, maintains that "FCS is no longer the same program that it was five years ago" and that the program is no longer focused on the creation of 15 FCS BCTs but instead about bringing FCS capabilities to all brigades across the Army.¹⁹ Army officials note that current combat vehicles were "designed in the 70's and fielded in the 80's," and they won't last forever and, that in an era of persistent conflict, "there will be no timeout for the Army to modernize."²⁰

Selected FCS Program Issues

The FCS program has been characterized as a large, risky, and highly complex program. The following sections address selected program issues, to include important supporting or what are known as complimentary programs that are necessary for FCS to achieve its full operational potential.

2008 Program Restructuring

On June 26, 2008, primarily in response to both congressional and Department of Defense (DOD) concerns about getting FCS technologies to forces in the field sooner and overall program affordability, the Army restructured the program. In an official press release, the Army announced the restructuring, characterizing it as an effort "to accelerate FCS deliveries to Infantry Brigade Combat Teams (IBCTs)."²¹ The Army now plans to field the following technologies to 43 IBCTs during the 2011 to 2025 time frame:²²

- Tactical and Urban Unattended Ground Sensors;
- Non-Line of Sight (NLOS) Launch System (NLOS-LS);
- Network Kits for High Mobility, Multi-Wheeled Vehicles (HMMWV);
- Class I Unmanned Aerial Vehicles (UAVs);
- Small Unmanned Ground Vehicles (SUGVs); and
- Ground Soldier Ensemble, a soldier-worn command and control system for dismounted soldiers modeled on the Army's Land Warrior System, which was terminated by the Army in FY2008.

¹⁸ Jason Sherman, "Lynn: Weapon System Modernization Blueprint Unsustainable," *Inside the Air Force*, January 16, 2009 and Dave Ahearn, "Experts See Deep Cuts Coming in Defense Procurement, Myriad Programs at Risk," *Defense Daily*, February 19, 2009.

¹⁹ Kate Brannen, "With New Administration Looming, Army Stresses the Utility of FCS," *InsideDefense.com*, December 22, 2008.

²⁰ Ibid.

²¹ U.S. Army News Release, "Army to Accelerate Future Combat Systems Deliveries (FCS) to Infantry Brigade Combat Teams," Army Public Affairs Office, Washington D.C., June 26, 2008.

²² Ann Roosevelt, "Army Tightens FCS Focus on Infantry and Current Fight," *Defense daily*, June 26, 2008; U.S. Army News Release, "Army to Accelerate Future Combat Systems Deliveries (FCS) to Infantry Brigade Combat Teams," Army Public Affairs Office, Washington D.C., June 26, 2008; and Daniel Wasserbly, "Bringing Soldiers Into the Network: Army to Align Ground Soldier Program with FCS Spin Out 1 Fielding," *InsideDefense.com*, June 30, 2008 and a FCS Acceleration Briefing provided to CRS on July 21, 2008.

The Army conducted a Preliminary Limited User Test (P-LUT) focused on infantry units at Ft. Bliss, TX, in July 2008 in lieu of a previously scheduled heavy FCS BCT Limited User Test. A formal LUT for the infantry BCT is scheduled for FY2009, and the Army hopes to “Spin Out” these technologies to IBCTs beginning in FY2011. The Army will alter its overall FCS testing schedule to accommodate the IBCT FCS spin outs. Army officials plan to field IBCT Spin Out One equipment to both Active and National Guard IBCTs, based on when the units are scheduled to deploy to Iraq or Afghanistan.²³

Current FCS High-Risk Areas²⁴

The Army has identified six current FCS high-risk areas:

- The performance of the Active Protection System (APS) that is intended to protect MGVs from short-range and long-range anti-tank systems.
- Protecting against rapidly evolving threats to the FCS network.
- Data transfers between FCS systems that have different data security classifications.
- Software development and integration.
- Network management functions for reliable on-the-move networking.
- Balancing MGV capabilities.

The Army contends that it has an active risk management program to address these and other risk areas, including risk management at all program levels, resourced risk mitigation plans, and weekly review by FCS program leadership.

Joint Tactical Radio System (JTRS)

JTRS radios are software-defined radios that are to be used to provide voice, video, and data communications to FCS manned and unmanned ground and aerial vehicles. One of the primary benefits of JTRS is that it is intended to operate on multiple radio frequencies, permitting it to talk to certain non-JTRS radios that are expected to stay in the Army's inventory. JTRS is a joint program and therefore is not a part of the FCS program but is instead what the Army describes as a “complimentary program.” JTRS is to form the “backbone” of the FCS Network and therefore of critical importance to the program's success. Some have criticized the JTRS family of radios as “falling short of what the FCS requires” in terms of capabilities, range, and encryption but note that without the high-bandwidth, all digital JTRS “there is simply no way to transmit the vast amount of data that the new [FCS] networks will require.”²⁵

²³ Daniel Wasserbly, “Testing Pushed Back to Next Summer: Army to Reprogram Funding in FY 08, FY 09 for FCS Spin Out 1 Changes,” *InsideDefense.com*, June 30, 2008.

²⁴ Information in this section is from a CRS meeting on the FCS Program with the Army's Capability Integration Center on March 3, 2009.

²⁵ Sydney J. Freedberg, “Army Struggles Towards the Goal of Wi-Fi Infantry,” *National Journal*, September 20, 2008.

Reductions in JTRS Procurement

A February 2009 Congressional Budget Office (CBO) report to the House Subcommittee on Air and Land Forces analyzes the Army's plans to equip its forces with wireless communications networks, including JTRS.²⁶ The report notes that:

The Department of Defense has encountered a number of problems in developing the JTRS ground mobile radio (GMR) and the handheld, manpack, small form factor (HMS) radio. The agency issued stop-work orders on contracts for those systems in 2005 and, in 2006, restructured the entire JTRS program and revised the associated contracts to incorporate a reduction in the capability of the radios to be purchased. That decision was made to lower costs and because DOD realized that not all of the originally planned capabilities were technically feasible.²⁷

Because of cost increases, program delays, technical difficulties, and less than anticipated capability, the Services have significantly reduced their plans for purchasing GMRs and HMSs. Between 2004 and 2007, the Army decreased its GMR planned purchases by 19%; the Marine Corps, by 91%; and the Air Force, by 89%.²⁸ Over the same timeframe, the Army reduced its HMS requirement by 66%; the Navy, by 72%; the Marines, by 68%; the Air Force, by 52%; and the U.S. Special Operations Command (USSOCOM)—who originally planned to acquire 52,163 HMSs—is no longer participating in the program.²⁹ Even though the other Services have drastically reduced their JTRS requirements, the Army plans to fund 80% of the entire JTRS program and will purchase 95% of the radios produced under the program through 2026. The significant reduction in the number of JTRS GMR and HMS radios to be procured raises issues for consideration. One issue is that with the Army now planning to buy 95% of the program's radios, it can be argued that the JTRS program has become more of an Army program than a joint program. Another concern is the apparent "vote of no confidence" in the GMR and HMS radios by the other Services and USSOCOM. While increased costs and program delays may be critical factors, it is possible that significantly decreased capabilities may be of prime concern, as the Services often will accept increased costs and delayed procurement if the system in question is fully capable. It is also possible that because overall procurement quantities have decreased significantly, that the per unit costs of the GMRs and HMSs may increase significantly.

***Less Costly JTRS Versions?*³⁰**

Reports suggest that defense officials are considering a less-costly, two-channel GMR version, which could cost 20% less than the \$220,000 per unit, four-channel GMR presently being developed by Boeing. The "GMR Lite," also being developed by Boeing, could be used to supplement four-channel GMRs, but analysts suggest that there needs to be a "business case" to justify the engineering expenses to develop the GMR Lite. It has been suggested that the GMR Lite could be used in smaller and non-combat vehicles, and the four-channel version in larger and

²⁶ Information in this section is taken from a CBO Report to the House Subcommittee on Air and Land Forces, "The Army's Wireless Communications Programs," February 11, 2009.

²⁷ Ibid., p. 3.

²⁸ Ibid., p. 4.

²⁹ Ibid.

³⁰ Information in this section is taken from Joe Gould, "Amid Budget Debate, Defense Officials Eye Less Costly JTRS Versions," *IndideDefense.com*, March 9, 2009.

command and control vehicles. General Dynamics is said to also be developing a two-channel HMS JTRS version that could cost \$15,000 per channel.

Potential Radio Spectrum Problems³¹

One report suggests that the Army's former Assistant Secretary of the Army for Acquisitions, Logistics, and Technology, Claude Bolton, was concerned that within the next five years, the Army may not have enough radio spectrum "to allow its next-generation networked force [FCS] to work as it is being designed to." The concern is that beginning in 2010, when the Army introduces JTRS and additional technologies designed to transmit vast amount of data from soldiers, sensors, and unmanned and manned ground and aerial vehicles, the available bandwidth will become overwhelmed. To get a better appreciation for the potential problem, both the Army Science Board and RAND Corporation have been asked to estimate the Army's future bandwidth needs, and the FCS program is investigating how FCS will perform if the network is degraded by lack radio spectrum availability and network.

Warfighter Information Network – Tactical (WIN-T)

WIN-T is described as the Army's "communications network of the future consisting of a three-tiered architecture of orbital, airborne, and ground links that will provide connectivity to a dispersed and highly mobile force."³² WIN-T is intended to permit the Army to communicate and transfer large amounts of data on the move and is a capability central to the success of the FCS program.³³

WIN-T Increments³⁴

The Army is presently fielding WIN-T Increment One (which began fielding in 2004 as Joint Network Node or JNN). WIN-T Increment One is intended to support static headquarters. WIN-T Increment Two is intended to provide network management and the mobile portion of the system, including on-the-move satellite communication (SATCOM) and networking line-of-sight radio. Testing of Increment Two is currently underway and if testing is successful, Increment Two equipment could begin to enter service in 2011.³⁵ WIN-T Increment Three is slated to enter service in 2015 and will link UAVs and other intelligence systems to on-the-move ground systems. WIN-T Increment Four is planned to include linkage to the U.S. Air Force's Transformational Communication Satellite (TSAT) system, which will provide a more capable and protected on-the-move SATCOM system.

³¹ Information in this section is taken from Kris Osborn "U.S. Army Faces Spectrum Crunch," *Defense News*, January 7, 2008; Sandra I. Erwin, "Army Struggling With Rising Demand for Communications," *National Defense*, April 2008; and Alec Klein, "Weapons Upgrade Faces Big Hurdles: Problems With Wireless Technology May Threaten Army's Ambitious Plans," *Washington Post*, April 8, 2008.

³² Scott Nance, "Analyst: Advanced Networks to be Rumsfeld Legacy," *Defense Today*, Volume 26, Number 233, December 8, 2005, p. 3.

³³ "Army Restructures WIN-T to Meet Future Combat System Requirements," *Inside the Army*, July 3, 2006 and Josh Rogin, "DOD: Projected WIN-T Costs Soars by \$2.2 Billion," *Federal Computer Weekly*, April 10, 2007.

³⁴ Information in this section is from Giles Ebbut, "WIN-T Restructuring Fuels Greater Demand," *Jane's International Defence Review*, December 2007, p. 17.

³⁵ Kris Osborn, "2nd WIN-T Phase Adds Ad-Hoc Networking to Moving Vehicles," *Defense News*, November 10, 2008, p. 16.

WIN-T Increment Costs³⁶

CBO notes that the Army used \$12 billion in supplemental funding to purchase about 1,100 WIN-T Increment One JNN equipment sets from 2004 to 2007. Beginning in 2009, the Army plans to acquire 1,837 Increment Two equipment sets at a total cost of more than \$3 billion. Increment Three, which will provide the Army with the “full set of on-the-move Internet communications capabilities of the original WIN-T program,” is still not yet fully defined and cost estimates are not available, although some believe that Increment Three will cost as much as the entire original WIN-T program, which was valued by some sources at a little over \$16 billion in 2007.³⁷ Because Increment Four is still in conceptual development, CBO has no information regarding the program schedule and potential costs.

WIN-T Testing³⁸

The Army and General Dynamics are making preparations to conduct a limited user test of WIN-T Increment 2 in late March 2009. If the test is successful, a production decision and contract award could occur in July 2009 to support the next phase of testing, the Initial Operational Test and Evaluation (IOT&E). If the IOT&E testing is successful, a full rate production decision is anticipated. General Dynamics is the prime systems integrator and is teamed with Lockheed Martin, BAE Systems, Harris Corporation, L-3 Communications, and Cisco Systems.

Delay in the Transformational Communications Satellite (TSAT) Program³⁹

In October 2008, the Pentagon decided to delay the award of a potential \$15 to \$20 billion contract for the TSAT until the fourth quarter of FY2010. TSAT is described as a constellation of satellites that securely transmit large quantities of data at unprecedented speeds, which should permit military forces to communicate more effectively on the move. Prior to the postponement, TSAT was scheduled to be available by 2015, but the delay now means that the earliest that the first TSAT satellites could be launched is around 2019. In December 2009, the TSAT program was restructured and scaled back and a new draft request for proposal (RFP) was issued. The final request for bids is anticipated in April 2009, and the winner of the approximately \$11 billion initial contract could be announced by April 2010. There is no guarantee, however, that the TSAT program will go forward, as some Members have expressed concerns about the program's proposed technologies as well as its cost, and some Pentagon acquisition officials believe that less-complex and less-costly alternatives are available.

³⁶ Information in this section is taken from a CBO Report to the House Subcommittee on Air and Land Forces, “The Army's Wireless Communications Programs,” February 11, 2009.

³⁷ Josh Rogin, “DOD: Projected WIN-T Costs Soars by \$2.2 Billion,” *Federal Computer Weekly*, April 10, 2007.

³⁸ Information in this section is taken from Ann Roosevelt, “Army Prepares for Limited User Test for General Dynamics' WIN-T Increment 2,” *Defense Daily*, March 10, 2009.

³⁹ Andrea Shalal-Esa, “Pentagon Postpones Big Satellite Contract Until FY10,” *Reuters.com*, October 20, 2008; Andy Pasztor, “Pentagon Delays Program to Build New Satellite,” *Wall Street Journal*, October 21, 2008; and Daniel Wasserbly, “Army: TSAT Delays Would Hinder FCS Comms, But Service Can Wait,” *InsideDefense.com*, October 27, 2008; Erik Holmes, “U.S. Air Force Details TSAT Plan,” *Defense News*, January 19, 2009, p. 23.

The Army's Position on the TSAT Program Delay⁴⁰

Army officials acknowledge that the TSAT delay affects FCSs' networking capabilities but that current satellites are sufficient until faster and more capable satellites become available. Army officials have said that TSAT is not required for the initial fielding of FCS BCTs in 2015 but, in order to achieve the Army's full vision of FCS, that the TSAT or an equivalent system will be required. Some suggest that the TSAT program is "sinking fast" and there is a possibility that the Army is downplaying the negative operational impact that a TSAT program termination could have on FCS.

FCS Armor Development⁴¹

The FCS MGCV is being developed with upgradable armor. The Army describes this as an "A plus B" replaceable armor system, where the A is the vehicle hull and B is attachable armor. Under this system, the MGCV hull or the "A" armor will remain essentially the same once prototyping is complete and the "B" armor will be improved over time to make it stronger and lighter and then attached the MGCV hull. The Army suggests that there are a number of benefits to this approach. One benefit is that the FCS MGCVs will theoretically be able to "add or change armor to confront emerging threats," which could result in extended utility of MGCVs as potential threats emerge. Other suggested benefits are that the MGCV could become lighter (therefore more transportable and maintainable) as newer generations of composite, ceramic, lightweight armors are developed. The ability to extend the operational life of MGCVs with upgradable armor may result in potential long-term cost savings. Information gained from the development of upgradable, modular armor is also being applied in the development and upgrading of Mine-Resistant, Ambush-Protected (MRAP) vehicles as well as individual body armor, which may also contribute potential cost savings in these programs as well.

FCS Manned Ground Vehicle Development⁴²

According to reports, the MGCV chassis—which is intended to be the common chassis for all eight MGCV variants—will likely pass an early 2009 preliminary design review, so that prototyping may begin in 2011. The MGCV offers a number of unique features, which may not only improve operational capabilities but could also result in cost savings over time. The MGCV is planned to have the Army's first hybrid propulsion system, incorporating a diesel internal combustion engine that will act as a generator, electric drive motors, and a battery system for energy storage. The Army maintains that some of the benefits include better fuel efficiency, the ability to generate significant amounts of power for onboard systems as well as to export outside the MGCV, silent running, and enhanced maintainability. The MGCV will also likely incorporate segmented band track, which should be lighter, less costly, more fuel-efficient, and easier to maintain than the tracks used currently on Army fighting vehicles. The Army believes that the MGCVs will also improve sustainability. Because the Army intends that there will be greater than 70%

⁴⁰ Ibid.

⁴¹ Information in this section is taken from a CRS visit to Aberdeen Proving Grounds, MD on January 23, 2009 for a demonstration of FCS MGCV development and associated advanced armor technologies and Kate Brannen, "Army Plans Series of Upgrades to FCS Manned Ground Vehicle Armor," *InsideDefense.com*, January 26, 2009.

⁴² Information in this section is taken from Marjorie Censer, "TARDEC Seeking Improvements in FCS Manned Ground Vehicle Design," *InsideDefense.com*, February 2, 2009 and the Army's FCS Website "Focus On: Manned Ground Vehicles," accessed February 25, 2009, <https://www.fcs.army.mil/mgcvfocus/commonchassis.html>.

commonality between the eight MGCV variants, that there will be a significantly reduced support burden in terms of dedicated soldiers, equipment, and support units which might translate into cost savings. The Army contends that 80 percent of the MGCV's potential maintenance problems can be fixed by the vehicle's crew, which should result in a "reduced logistics foot print." The Army notes that the MGCV program, as currently envisioned, represents a significant domestic financial impact. The current MGCV program is said to encompass "more than 839 suppliers in 38 states totaling more than \$6.2 billion in development cost impact." This aspect of the program could become a significant consideration if the FCS program is targeted for restructuring by the Administration.

FCS Program Budget Issues

FY2009 FCS Budget Request⁴³

The Administration requested \$3.7 billion for FY2009—with approximately \$3.3 billion for R&D and approximately \$300 million for procurement. Procurement funds include the manufacturing and assembly of the first six Non-Line-of-Sight Cannons (NLOS-C) to be fielded in FY2010 and FY2011 and for software and communications packages that are intended to link the FCS network to M-1 Abrams, M-2 Bradleys, and modified wheeled vehicles that will serve as surrogates for FCS MGCVs during FCS initial operational tests scheduled for FY2011.

FCS—FY2009 Defense Authorization and Appropriations⁴⁴

The Senate Armed Services Committee (SASC) recommended fully funding the President's FCS FY2009 Budget Request. The House Armed Services Committee (HASC) Air and Land Subcommittee initially recommended \$ 200 million less than the President's Budget Request.

The Duncan Hunter National Defense Authorization Act for FY2009 (S. 3001/P.L. 110-417) authorized an increase in FCS RDT&E funding by \$33 million while reducing procurement funding by \$137.7 million—a net reduction of \$104.7 million as opposed to the original HASC-proposed \$200 million reduction.⁴⁵ The FY2009 National Defense Authorization Act (NDAA) also contained the following FCS-related provisions:⁴⁶

- (Section 111) Beginning with the FY2011 Budget Request, requiring separate procurement funding lines for five FCS equipment classes, including manned ground vehicles, unmanned ground vehicles, unmanned aerial vehicles, unattended ground sensors, and "other FCS elements";

⁴³ Information in this section is taken from "The Army Budget - Fiscal Year 2009," U.S. Army News Release, Army Public Affairs Office, February 4, 2008 and Daniel Wasserbly, "Army's FY-09 Budget Includes \$3.6 Billion for Future Combat Systems," *InsideDefense.com*, February 11, 2008.

⁴⁴ For additional information on FY2009 Defense Authorizations and Appropriations, see CRS Report RL34473, *Defense: FY2009 Authorization and Appropriations*, by Pat Towell, Stephen Daggett, and Amy Belasco; Press Release, United States Senate Committee on Armed Services, "Senate Armed Services Committee Completes Markup of National Defense Authorization Bill for Fiscal Year 2009," May 1, 2008; John M. Donnelly, "Defense: House Armed Services Panel Aims at Administration's Defense Priorities," *CQ Today*, May 7, 2008, p. 11.

⁴⁵ S. 3001: Duncan Hunter FY2009 National Defense Authorization Act Summary, p. 14.

⁴⁶ Joint Explanatory Statement to Accompany S. 3001, September 2008.

- (Section 112) A measure that would prohibit the Army from awarding new low-rate or full-rate production contracts for “major systems or subsystems” of FCS to companies serving as the program’s lead systems integrator. Under this provision, program prime contractors would be considered a lead systems integrator until 45 days after the Secretary of the Army certifies to congressional defense committees that the contractor is no longer serving as a lead systems integrator;
- (Section 211) Adds provisions to the FY2009 NDAA (P.L. 109-364) mandated FCS Systems Milestone Review addressing the use of actual demonstrations—as opposed to simulations—to demonstrate that software development is on a path to achieve threshold cost and schedule requirements; if demonstrations of the communications networks are adequate to inform major program decision points; the extent to which FCS MGVs are degraded if FCS communications are degraded; how resistant is the FCS communications network to network attacks, jamming, and interference; total program cost estimate (including spin-outs) and confidence level in that estimate; and a program affordability assessment based on the above-mentioned cost estimate and projected Army budgets.
- (Section 212) Requires that the Assistant Secretary of Defense for Networks and Integration to submit a report to congressional defense committees by September 30, 2009, on the FCS communications network and software. The report is to include an assessment of the vulnerability of FCS to enemy network attacks; electronic warfare and jamming; and adverse weather and complex terrain. Also the report is to cover FCS’s dependence on satellite communications support, including network performance in the absence of assumed satellite communications support. The report will also address how a degraded network would affect FCS performance and MGV survivability. The report will also include an assessment developed in coordination with the Director of Operational Testing and Evaluation (DOT&E) on the adequacy of the FCS communications network testing schedule as well as an assessment also involving DOT&E on funding, schedule, and technological maturity of WIN-T and JTRS as they relate to the FCS program, including spin outs.
- (Section 213) Beginning February 15, 2009, through 2015, the Secretary of the Army is required to submit a Selected Acquisition Report in accordance with Section 2432, Title 10, United States Code, for each variant of the FCS manned ground vehicle (MGV).

FCS and FY2009 Defense Appropriations ⁴⁷

H.R. 2638 (P.L. 110-329) the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act of 2009 provided for, among other things, continuing appropriations for defense activities that would be covered under a regular FY2009 defense appropriations bill. Under the provisions of this act, the restructured FCS program was fully funded and \$2.6 billion

⁴⁷ U.S. Senate Committee on Appropriations Press Release, “Senate Defense Appropriations Subcommittee Approves Fiscal Year 2009 Defense Appropriations Bill,” September 23, 2008 and House Committee on Appropriations Press Release, “Summary: 2009 Defense Appropriations,” September 22, 2008.

above the President's request was added to accelerate the unmanned aerial and ground vehicle programs.

FCS Cost Estimates

In March 2006, GAO estimated that the current total cost for the FCS program was \$160.7 billion (then-year dollars)—an increase of 76% over the Army's first estimate.⁴⁸ In July 2006, the Department of Defense's Cost Analysis Improvement Group (CAIG) estimated that the total cost for the development, procurement and operations of FCS had increased to more than \$300 billion.⁴⁹ The Army maintains that the total cost for the FCS program will be roughly \$230 billion, based on an April 2006 estimate from the FCS Program Office.⁵⁰ An August 2006 Congressional Budget Office (CBO) study postulated that, given historic cost growth in similar programs, that annual FCS costs could reach \$16 billion annually, exceeding the Army's estimates of \$10 billion annually.⁵¹ The Army has disputed CBO's estimates, calling them "seriously flawed" suggesting that CBO does not address the strategic environment or changing operational requirements.⁵² In June 2007, the Institute for Defense Analysis (IDA)—a nonprofit corporation that administers three federally funded research and development centers—reportedly concluded that the FCS program would cost \$13 billion more than what the Army has estimated, a conclusion that the Army has rejected.⁵³ Some maintain that this wide disparity in FCS cost estimates eight years into the program has resulted in a lack of confidence that the FCS program can be conducted in a cost-efficient manner.

On April 7, 2008 DOD provided Congress with revised cost estimates on a number of defense acquisition programs. DOD revised the total FCS program cost downward by 1.6% to just over \$159.3 billion, primarily due to the application of revised inflation indices, but also including past incorrect indices, decreases in other program support, and congressional statutory reductions.⁵⁴

⁴⁸ Government Accountability Office (GAO) Report "Acquisitions: Business Case and Business Arrangements Key for Future Combat System's Success," GAO-06-478T, March 1, 2006, p. 8.

⁴⁹ Megan Scully, "Army Sticks to its Guns, Rejects New FCS Cost Estimates," *National Journal's Congress Daily AM*, July 13, 2006.

⁵⁰ Ibid.

⁵¹ "The Army's Future Combat Systems Program and Alternatives," A CBO Study, August 2006, p. xii.

⁵² Ann Roosevelt, "Army Calls CBO's FCS Report Seriously Flawed," *Defense Daily*, Vol. 231, No. 52, September 19, 2006.

⁵³ Daniel Wasserbly, "Study: Army FCS Program Will Cost \$13 Billion More Than Estimated," *InsideDefense.com*, July 30, 2007.

⁵⁴ DOD Press Release, "Department of Defense Releases Selected Acquisitions Reports," Number 276-08, April 7, 2008 and Marina Malenic, "DOD Revises FCS Cost Downward Using New Inflation Indices," *Inside Defense.com*, April 14, 2008.

Potential Issues for Congress

What Is the Future of the 15 FCS BCTs?

The Army's June 2008 FCS program reorganization focuses exclusively on providing FCS technologies to IBCTs for the "current fight," although it might be argued that fielding FCS Spin Out One in 2011 to the first of 43 IBCTs does not adequately address the needs of commanders in the field today. The lack of detail about how the 15 FCS BCTs fit into this reorganization and re-prioritization could lead to speculation that the Army does not intend to field 15 FCS BCTs by 2030. If this is the case, there are significant operational and budgetary issues associated with any plans to scale back or lengthen the 15 FCS BCT fielding that Congress might wish to explore with the Army and DOD.

What Are the Programmatic, Budgetary, and Operational Impacts of the June 2008 Program Restructuring?

The June 2008 restructuring will provide FCS technologies to IBCTs sooner than originally planned. This focus on IBCTs might be viewed by some as a concession by the Army that FCS BCTs are less relevant in counterinsurgency and stabilization operations than IBCTs, which operate dismounted and have a greater interaction with civilians. While this restructuring might prove to be beneficial, there are a number of longer-term programmatic, budgetary, and operational impacts associated with this action. Will the FCS program need to be extended beyond 2030? If FCS BCTs are to be reduced or eliminated, what is the impact on the M-1 Abrams and M-2 Bradley Programs? What are the long-term budgetary implications of the 2008 restructuring—will it increase or decrease the total FCS program cost? How will this restructuring change the tactical and operational employment of the Army throughout the entire spectrum of operations? Will the restructuring result in a less or more capable FCS-equipped force? How will the restructuring affect how the Army conducts operations with the other Services and allies?

How Are Major Complementary Programs Affecting the Development of FCS Units?

While many FCS unmanned and manned ground and aerial vehicles are in prototyping phases and, in some instances, actually being deployed into combat,⁵⁵ there are concerns that complementary programs—viewed as essential for FCS to achieve its full potential—are not achieving the same level of success. The JTRS program, which has been criticized as "falling short of what FCS requires," raises some concerns. The decrease in the numbers of GMR and HMS JTRS versions that the other Services and U.S. SOCOM intend to procure, the significant per unit cost of the four-channel versions, and the development of less costly and less capable versions of these radios calls into question the viability of the entire JTRS program. There is also concern that WIN-T Increments Three and Four are still not as well defined as they should be. In the case of Increment Four, the final increment intended to tie FCS to the TSAT system, the

⁵⁵ Matthew Cox, "Guard Stryker Brigade to Deploy with FCS UAVs," *Army Times*, November 25, 2008.

uncertain future of the TSAT program likely has a highly detrimental impact on program planning and budgeting. It also appears that the overall WIN-T program costs are not yet determined, which could be a significant issue given current and projected future budgetary constraints.

Requirements mandated in Sections 211 and 212 of the FY2009 NDAA (P.L. 110-417) should provide Congress with some preliminary insights on how JTRS, radio spectrum difficulties, WIN-T development, and potential lack of a TSAT system could affect FCS survivability and effectiveness. The value of these insights are predicated on the level of detail that the Army and DOD incorporates into these congressional requirements and reports. In particular, Section 211's requirements to include a number of these factors into the FCS System Design review could prove useful in assessing the future viability of the FCS program.

Progress in MGV Development

The MGV common chassis offers a number of potential benefits that will likely be of prime consideration when evaluating the future of the FCS program. The MGV's replaceable and upgradeable armor, hybrid propulsion system, fuel efficiency, and improved maintainability and sustainability could result in long-term operational cost savings. As a common chassis for the Army's tracked vehicle fleet, which could number in the thousands, the MGV might also permit the Army to decrease the number of personnel that not only crew these vehicles, but also who maintain and repair them as well, possibly resulting in a reduction of related personnel costs. A greater than 70% commonality in parts between the eight MGV versions might also result in cost savings in parts and repair and maintenance tools.

The Financial Crisis, Constrained Defense Budgets, and the Future of FCS⁵⁶

A number of experts suggest that the current financial crisis could decide the ultimate fate of the FCS program. Some Members have noted that the financial crisis will add to demands on the federal budget and force reductions in military spending and that the former approach where the Services "got what the asked for" is no longer realistic. The Administration and DOD leadership are said to be closely examining the FCS program in terms of affordability and relevance to the current conflicts. Some DOD officials maintain that the U.S. military should prepare for a period of constrained defense budgets in light of the current economic downturn and global credit crisis. In this regard, some believe that the Pentagon will be called on to cancel program outright, as opposed its past approach, whereby smaller budget cuts were imposed across all programs. If this does become the case, FCS has been mentioned, along with Missile Defense, as a candidate for cancellation. Some senior officers note that if we fail to invest in weapons systems such as FCS, we could leave U.S. forces ill-equipped to fight modernized adversaries in the future. It is likely that the financial crisis will be a significant new dimension in the FCS affordability argument and will be an issue of interest for the 111th Congress.

⁵⁶ John Reed and Jason Sherman, "Murtha: Wall Street Bailout Will Squeeze Future Defense Budgets," *Inside the Pentagon*, September 25, 2008; Emelie Rutherford, "Danzig: Obama Would Examine Army's Future Combat Systems, National Missile Defense," *Defense Daily*, October 3, 2008; Jason Sherman, "Panel: Fiscal Constraints Will Force Next Defense Secretary to Consider Program Kills," *InsideDefense.com*, October 29, 2008; and August Cole and Yochi J. Dreazen, "Boots on the Ground or Weapons in the Sky?," *Wall Street Journal*, October 20, 2008.

Additional Reading

CRS Report RL32476, *U.S. Army's Modular Redesign: Issues for Congress*, by Andrew Feickert.

CRS Report RS22707, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress*, by Andrew Feickert.

CRS Report RL33161, *The Joint Tactical Radio System (JTRS) and the Army's Future Combat System (FCS): Issues for Congress*, by Andrew Feickert.

CRS Report RL34333, *Does the Army Need a Full-Spectrum Force or Specialized Units? Background and Issues for Congress*, by Andrew Feickert.

CRS Report RS21195, *Evolutionary Acquisition and Spiral Development in DOD Programs: Policy Issues for Congress*, by Gary J. Pagliano and Ronald O'Rourke.

Appendix. FCS Subsystems

Manned Ground Vehicles

FCS manned ground vehicles (MGVs) are a family of eight different combat vehicles—with some having more than one variation—that are based on a common platform and are being designed to be air transportable by the U.S. Air Force. They are to be equipped with a variety of passive and active protection systems and sensors that the Army hopes will offer them the same survivability as the current heavy armor force. In addition the Army intends for its MGVs to be highly reliable, require low maintenance, and have fuel-efficient engines. The following are brief descriptions of MGV types and variants. All are intended to have a range of 750 kilometers and a top speed of 90 kilometers per hour (kph)—55 miles per hour.⁵⁷

Mounted Combat System (MCS) (XM1202)

As envisioned, the MCS provides direct and beyond-line-of-sight (BLOS) fires, is capable of providing direct fire support to dismounted infantry, and can attack targets with BLOS fires out to a range of 8 kilometers. The MCS is intended to replace the current M-1 Abrams tank. The MCS is to have a crew of two and might also be able to accommodate two passengers. The MCS is to be armed with a 120 mm main gun, a .50 caliber machine gun, and a 40 mm automatic grenade launcher.

Infantry Carrier Vehicle (ICV) (XM1206)

As planned, the ICV consists of four versions: the Company Commander version, the Platoon Leader version, the Rifle Squad version, and the Weapons Squad version. All four versions appear to be identical from the exterior to prevent the targeting of a specific carrier version. The Rifle Squad version is to have a two-man crew, and is to be able to transport a nine-man infantry squad and dismount them so that they can conduct combat operations on foot. The ICV is to mount a 30 or 40 mm cannon.

Non-Line-of-Sight Cannon (NLOS-C) (XM1203)

The NLOS-C is to provide networked, extended-range targeting and precision attack of both point and area targets with a wide variety of munitions. Its primary purpose will be to provide responsive fires to FCS Combined Arms Battalions and their subordinate units. The NLOS is to have a two-man crew and a fully automated handling, loading, and firing capability.

Non-Line-of-Sight Mortar (NLOS-M) (XM1204)

The NLOS-M is intended to provide indirect fires in support of FCS companies and platoons. The NLOS-M is to have a four-man crew, mount a 120mm mortar, and also carry an 81 mm mortar for dismounted operations away from the carrier.

⁵⁷ Information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004, and the *FCS Brigade Combat Team*, August 22, 2007.

Reconnaissance and Surveillance Vehicle (RSV) (XM1201)

As planned, the RSV will feature advanced sensors to detect, locate, track, and identify targets from long ranges under all climatic conditions, both day and night. The RSV is to have a mast-mounted long-range, electro-optical infra-red sensor, sensors for radio frequency (RF) intercept and direction finding as well as a remote chemical warfare agent detector. RSVs are to also carry four dismounted scouts, unattended ground sensors (UGS), a Small Unmanned Ground Vehicle (SUGV) with various payloads, and two Unmanned Aerial Vehicles (UAVs). In addition to the four scouts, the RSV is to have a two-man crew and a defensive weapons system.

Command and Control Vehicle (C2V) (XM1209)

The C2V is intended to serve as the “hub” for battlefield command and control. It is to provide information management for the integrated network of communications and sensors for the FCS brigade combat teams. The C2V is to have a crew of two and carry four staff officers and also be capable of employing UAVs.

Medical Vehicle - Evacuation (MV-E) (XM1207) and Medical Vehicle - Treatment (MV-T) (XM1208)

There are to be two versions of the MV: the MV-E and MV-T. The MV-E would permit combat trauma specialists to be closer to the casualty's point of injury as it is to move with combat forces and evacuate casualties to other treatment facilities. The MV-T is to enhance the ability to provide Advanced Trauma Management/Advanced Trauma Life Support forward in the battle area and both MV-E and MV-T would be capable of conducting medical procedures and treatments using telemedicine systems. Both would have four-man crews and the capability to carry four patients.

Field Recovery and Maintenance Vehicle (FRMV) (XM1205)

The FRMV would be the FCS Brigade Combat Team's recovery and maintenance system. The FRMV is to have a crew of three, plus additional space for up to three recovered crew members.

Unmanned Aerial Vehicles (UAVs)⁵⁸

Each FCS-equipped brigade will have a number of UAVs.⁵⁹ While these UAVs are to provide a variety of capabilities to forces on the ground, some experts note that they could also present an air space management challenge to not only manned Army aviation assets, but also to Navy, Marine Corps, Air Force, and other nation's aircraft that might be providing support to Army ground operations. The following are brief descriptions of the Army's two classes of UAVs:

⁵⁸ Unless otherwise noted, UAV information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004 and the *FCS Brigade Combat Team*, August 22, 2007.

⁵⁹ Sandra I. Erwin, “Army to Field Four Classes of UAVs,” *National Defense*, April 2003.

Class I UAVs (XM156)

Class I UAVs are intended to provide Reconnaissance, Surveillance, and Target Acquisition (RSTA) at the platoon level. Weighing less than 15 pounds each, these Class I UAVs are intended to operate in urban and jungle terrain and have a vertical takeoff and landing capability. They are to be used to observe routes and targets and can provide limited communications transmissions relay. The Class I UAV are to be controlled by dismounted soldiers and can also be controlled by selected FCS ground platforms, and have an endurance of 50 minutes over an 8 kilometer area, and a 10,500 foot maximum ceiling.

Class IV UAVs (XM157)

Class IV UAVs are intended to provide the FCS brigade commander with a long endurance capability. It is intended to stay aloft for 72 continuous hours and operate over a 75 kilometer radius with a maximum ceiling of 16,500 feet. It is also planned to interface with other manned and unmanned aerial vehicles and be able to take off and land without a dedicated airfield.

Unmanned Ground Vehicles (UGVs)⁶⁰

Armed Robotic Vehicle - Assault Light (ARV- AL) (XM1219)

The ARV was originally intended to come in two variants—the Assault variant and the Reconnaissance, Surveillance, and Target Acquisition (RSTA) variant. The RSTA variant has been deferred as part of the Army's 2007 FCS program restructuring. The two variants were to share a common chassis. The Assault Light variant is to provide remote reconnaissance capability, deploy sensors, and employ its direct fire weapons and special munitions at targets such as buildings, bunkers, and tunnels. It is also intended to be able to conduct battle damage assessments, act as a communications relay, and support both mounted and dismounted forces with direct and anti-tank fire as well as occupy key terrain.

Small Unmanned Ground Vehicle (SUGV) (XM1216)

The SUGV is a small, lightweight, manportable UGV capable of operating in urban terrain, tunnels, and caves. The SUGV will weigh 30 pounds, operate for 6 hours without a battery recharge, and have a one kilometer ground range and a 200 meter tunnel range. Its modular design will permit a variety of payloads which will enable it to perform high-risk intelligence, surveillance, and reconnaissance (ISR) missions, and chemical weapons or toxic industrial chemical reconnaissance.

Multifunctional Utility/Logistics and Equipment Vehicle (MULE)

The MULE is a UGV that will support dismounted infantry. It is to come in two variants sharing a common chassis—a transport variant (XM1217) and a countermine variant (XM1218). The transport variant is to be able to carry 1,900 to 2,400 pounds of equipment and rucksacks for

⁶⁰ Unless otherwise noted, information for these descriptions are taken from two Army sources: The Army's *FCS 18+1+1 White Paper*, dated October 15, 2004 and the *FCS Brigade Combat Team*, August 22, 2007.

dismounted infantry and follow them in complex and rough terrain. The countermine variant is to have the capability to detect, mark, and neutralize anti-tank mines.

Unattended Ground Sensors (UGS)⁶¹

UGS are divided into two groups—Tactical UGS and Urban UGS—and are described as follows:

Tactical UGS (AN/GSR-10)

Tactical UGS include intelligence, surveillance, and reconnaissance (ISR) sensors and Chemical, Biological, Radiological, and Nuclear (CBRN) sensors. These sensors are to employ a variety of sensing technologies and integrated into the overall FCS network. They are intended to be deployed by hand, by vehicle, or by robot and have a 48 hour endurance. They are intended to be expendable, low-cost sensors used for such tasks as perimeter defense, surveillance, target acquisition, and CBRN early warning.

Urban UGS (AN/GSR-9)

Urban UGS can also be employed by soldiers, vehicles, or robots and are intended to provide situation awareness inside and outside of buildings for force protection and also for previously cleared buildings and areas.

Non-Line-of-Sight Launch System (NLOS-LS) (XM501)

NLOS-LS is to consist of missiles in a deployable, platform-independent, container launch unit (CLU), which can be fired in an unmanned and remote mode. Each CLU is to have a fire control system and 15 missiles consisting of Precision Attack Missiles (PAM).

The PAM is to have two employment modes—a direct-fire and a fast attack mode or a boost-glide mode. The missile is intended to receive target information prior to launch and receive and respond to target location updates while in flight. The PAM can be fired in the laser-designated mode and transmit near real-time target imagery prior to impact.

The Network⁶²

The FCS network is considered the most crucial system of all 14 systems. The FCS network is to consist of four interactive components—the System-of-Systems Common Operating Environment (SOSCOE); Battle Command (BC) software; communications and computers (CC); and intelligence, reconnaissance and surveillance (ISR) systems.

⁶¹ Ibid.

⁶² Ibid.

System-of-Systems Common Operating Environment (SOSCOE)

The SOSCOE is to enable the integration of a variety of software packages into the FCS network. It is intended to use commercial, off-the-shelf hardware and allow for the integration of critical interoperability packages that translate Army, Navy, Air Force, Marine Corps, and allied message formats into internal FCS message formats.

Battle Command (BC) Software

Battle Command mission applications are to include mission planning and preparation, situational understanding, battle command and mission execution, and warfighter-machine interface.

Mission Planning and Preparation

Consists of 16 different functions that provide FCS units with the following automated capabilities:

- The development of deliberate, anticipatory, and rapid-response plans;
- The ability to perform plan assessments and evaluations;
- The ability to perform terrain analysis;
- The conduct of mission rehearsals; and
- The conduct of after action reviews.

Situational Understanding

This consists of 10 different packages that allow the user to better comprehend his surroundings. These packages employ map information and a variety of databases that help to determine enemy locations and capabilities, infer enemy intentions, and assess the threat to U.S. forces.

Battle Command and Execution

This package contains a variety of planning and decision aids to help commanders make rapid, informed, and accurate decisions during battle. These packages can also be used in the training and rehearsal modes.

Warfighter-Machine Interface Package

This package receives soldier-generated information and displays information across all FCS platforms for soldier use.

Communications and Computer (CC) Systems

The Communications and Computer network is intended to provide secure, reliable access to information over extended distances and complex terrain. This network is not intended to rely on a large and separate infrastructure because it is to be embedded in the FCS mobile platforms and move with the combat units. The communications network is to consist of a variety of systems

such as the Joint Tactical Radio System (JTRS); Wideband Network Waveform and Soldier Radio Waveform systems; Network Data Link; and the Warfighter Information Network Tactical (WIN-T).

Intelligence, Reconnaissance and Surveillance (ISR) Systems

The Intelligence, Reconnaissance and Surveillance System is to be a distributed and networked array of multispectral ISR sensors intended to provide timely and accurate situational awareness to the FCS force. In addition, the ISR system is intended to help FCS formations avoid enemy fires while providing precision, networked fires to the unit.

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